CLAIMS

1. A method for scheduling data transmission for a plurality of terminals in a wireless communication system, comprising:

forming at least one set of terminals for possible data transmission for each of a plurality of frequency bands, wherein each set includes one or more terminals and corresponds to a hypothesis to be evaluated;

evaluating the performance of each hypothesis;

selecting one hypothesis for each frequency band based on the evaluated performance; and

scheduling the one or more terminals in each selected hypothesis for data transmission on the corresponding frequency band.

2. The method of claim 1, wherein each frequency band corresponds to a respective group of one or more frequency subchannels.

3. The method of claim 1, wherein the plurality of terminals are scheduled for downlink data transmission.

4. The method of claim 3, further comprising:

forming one or more sub-hypotheses for each hypothesis, wherein each sub-hypothesis corresponds to specific assignments of a plurality of transmit antennas to the one or more terminals in the hypothesis, and wherein the performance of each sub-hypothesis is evaluated and one sub-hypothesis is selected for each frequency band based on the evaluated performance.

5. The method of claim 3, further comprising:

assigning a plurality of transmit antennas to the one or more terminals in each hypothesis, and wherein the performance of each hypothesis is evaluated based in part on the antenna assignments for the hypothesis.

6. The method of claim 5, wherein the assigning for each hypothesis includes

identifying a transmit antenna and terminal pair with a best metric among all unassigned transmit antennas,

assigning the transmit antenna in the pair to the terminal in the pair, and

removing the assigned transmit antenna and terminal from consideration for the hypothesis.

7. The method of claim 5, wherein the plurality of transmit antennas are assigned to the one or more terminals in each hypothesis based on a priority of each terminal.

8. The method of claim 7, wherein the highest priority terminal in each hypothesis is assigned a transmit antenna associated with a highest throughput, and the lowest priority terminal in the hypothesis is assigned a transmit antenna associated with a lowest throughput.

9. The method of claim 3, further comprising:

forming a channel response matrix for a plurality of terminals in a particular hypothesis, and wherein the performance of the hypothesis is evaluated based on the channel response matrix.

10. The method of claim 9, wherein the evaluating includes

deriving a matrix of steering vectors to be used to generate a plurality of beams for the plurality of terminals in the particular hypothesis.

11. The method of claim 10, further comprising:

deriving a scaling matrix to be used to adjust transmit power for each terminal in the particular hypothesis.

12. The method of claim 1, wherein the plurality of terminals are scheduled for uplink data transmission.

13. The method of claim 12, further comprising:

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forming one or more sub-hypotheses for each hypothesis, wherein each sub-hypothesis corresponds to a specific ordering of the one or more terminals in the hypothesis, and wherein the performance of each sub-hypothesis is evaluated and one sub-hypothesis is selected for each frequency band based on the evaluated performance.

14. The method of claim 13, wherein one terminal ordering is formed for each hypothesis based on a priority of each terminal in the hypothesis.

15. The method of claim 13, wherein each sub-hypothesis is evaluated by

processing signals hypothetically transmitted from the one or more terminals in the sub-hypothesis to provide processed signals, and

estimating signal-to-noise-and-interference ratios (SNRs) for the processed signals.

16. The method of claim 15, wherein the SNRs for the processed signals are dependent on a particular order in which the hypothetically transmitted signals are processed, and wherein the hypothetically transmitted signals are processed in a specific order determined by the terminal ordering for the sub-hypothesis being evaluated.

17. The method of claim 15, wherein one sub-hypothesis is formed for each hypothesis, and wherein the terminal ordering for the sub-hypothesis is determined based on the SNRs for the processed signals.

18. The method of claim 15, wherein one sub-hypothesis is formed for each hypothesis, and wherein transmitted signals from a lowest priority terminal in the hypothesis are processed first and transmitted signals from a highest priority terminal are processed last.

19. The method of claim 12, wherein the performance of each hypothesis is evaluated based on successive cancellation receiver processing.

20. The method of claim 19, wherein the successive cancellation receiver processing performs a plurality of iterations to recover a plurality of signals

hypothetically transmitted from the one or more terminals in each hypothesis, one iteration for each hypothetically transmitted signal to be recovered.

21. The method of claim 20, wherein each iteration includes

processing a plurality of input signals in accordance with a particular equalization scheme to provide a plurality of processed signals,

detecting the processed signal corresponding to the hypothetically transmitted signal being recovered in the iteration to provide a decoded data stream, and

selectively deriving a plurality of modified signals based on the input signals and having interference components due to the decoded data stream approximately removed, and

wherein the input signals for a first iteration are signals received from the one or more terminals in the hypothesis being evaluated and the input signals for each subsequent iteration are the modified signals from a preceding iteration.

22. The method of claim 1, wherein each hypothesis is evaluated based in part on channel state information (CSI) for each terminal in the hypothesis.

23. The method of claim 22, wherein the channel state information comprises signal-to-noise-and-interference ratios (SNRs).

24. The method of claim 23, wherein each set of one or more terminals to be evaluated for a particular frequency band is associated with a respective matrix of SNRs achieved by the one or more terminals in the set for that frequency band.

25. The method of claim 22, wherein the channel state information comprises a channel gain for each transmit-receive antenna pair to be used for data transmission.

26. The method of claim 1, further comprising:

determining a data rate for each data stream to be transmitted for each scheduled terminal, and wherein a plurality of data steams are transmitted at the determined data rates.

27. The method of claim 26, further comprising:

determining a coding and modulation scheme to be used for each data stream to be transmitted, and wherein the plurality of data streams are processed based on the determined coding and modulation schemes prior to transmission.

28. The method of claim 1, wherein the plurality of terminals are scheduled for data transmission over a plurality of spatial subchannels.

29. The method of claim 28, wherein each selected hypothesis includes a plurality of SIMO terminals, wherein each SIMO terminal is assigned one spatial subchannel.

30. The method of claim 28, wherein each selected hypothesis includes a single MIMO terminal assigned all spatial subchannels.

31. The method of claim 28, wherein each selected hypothesis includes a combination of SIMO and MIMO terminals, wherein each SIMO terminal is assigned one spatial subchannel and each MIMO terminal is assigned two or more spatial subchannels.

32. The method of claim 1, wherein at least one set includes a plurality of MISO terminals each having a single antenna to receive a downlink data transmission.

33. The method of claim 1, wherein each set of multiple terminals includes terminals having similar link margins.

34. The method of claim 1, wherein the evaluating for each hypothesis includes

computing a performance metric for the hypothesis.

35. The method of claim 34, wherein the performance metric is a function of an overall throughput achievable by the one or more terminals in the hypothesis for a particular frequency band.

36. The method of claim 35, wherein the throughput for each terminal in the hypothesis is determined based on a signal-to-noise-and-interference ratio (SNR) achieved by the terminal for the particular frequency band.

37. The method of claim 35, wherein the throughput for each terminal is determined based on a signal-to-noise-and-interference ratio (SNR) achieved by the terminal for each of a plurality of frequency subchannels in the particular frequency band.

38. The method of claim 34, wherein for each frequency band the hypothesis having the best performance metric is selected for scheduling.

39. The method of claim 1, further comprising:

prioritizing the plurality of terminals to be scheduled for data transmission.

40. The method of claim 39, further comprising:

selecting a group of N highest priority terminals to be considered for scheduling for each frequency band, where N is one or greater.

41. The method of claim 39, further comprising:

maintaining one or more metrics for each terminal to be considered for scheduling, and wherein the priority of each terminal is determined based on the one or more metrics maintained for the terminal.

42. The method of claim 41, wherein one metric maintained for each terminal relates to an average throughput achieved by the terminal.

43. The method of claim 39, wherein the priority of each terminal is determined based on one or more factors maintained for the terminal and associated with quality of service (QoS).

44. In a multiple-input multiple-output (MIMO) communication system utilizing orthogonal frequency division multiplexing (OFDM), a method for scheduling downlink data transmission for a plurality of terminals, comprising:

forming at least one set of terminals for possible data transmission for each of a plurality of frequency bands, wherein each set includes one or more terminals and corresponds to a hypothesis to be evaluated, and wherein each frequency band corresponds to a respective group of one or more frequency subchannels;

forming one or more sub-hypotheses for each hypothesis, wherein each sub-hypothesis corresponds to specific assignments of a plurality of transmit antennas to the one or more terminals in the hypothesis;

evaluating the performance of each sub-hypothesis;

selecting one sub-hypothesis for each frequency band based on the evaluated performance; and

scheduling the one or more terminals in each selected sub-hypothesis for downlink data transmission on the corresponding frequency band.

45. The method of claim 44, wherein the evaluating for each sub-hypothesis includes

determining an overall throughput for the one or more terminals in the sub-hypothesis based on the specific antenna assignments, and

wherein for each frequency band the sub-hypothesis with the highest throughput is selected.

46. The method of claim 44, wherein one set of terminals is formed, and wherein the one or more terminals in each set are selected based on priority.

47. In a multiple-input multiple-output (MIMO) communication system utilizing orthogonal frequency division multiplexing (OFDM), a method for scheduling downlink data transmission for a plurality of terminals, comprising:

forming at least one set of terminals for possible data transmission for each of a plurality of frequency bands, wherein each set includes a plurality of terminals and corresponds to a hypothesis to be evaluated, and wherein each frequency band corresponds to a respective group of one or more frequency subchannels;

forming a channel response matrix for the plurality of terminals in each hypothesis;

evaluating the performance of each hypothesis based on the channel response matrix;

selecting one hypothesis for each frequency band based on the evaluated performance; and

scheduling the one or more terminals in each selected hypothesis for downlink data transmission on the corresponding frequency band.

48. In a multiple-input multiple-output (MIMO) communication system utilizing orthogonal frequency division multiplexing (OFDM), a method for scheduling uplink data transmission for a plurality of terminals, comprising:

forming at least one set of terminals for possible data transmission for each of a plurality of frequency bands, wherein each set includes one or more terminals and corresponds to a hypothesis to be evaluated, and wherein each frequency band corresponds to a respective group of one or more frequency subchannels;

forming one or more sub-hypotheses for each hypothesis, wherein each sub-hypothesis corresponds to a specific ordering of the one or more terminals in the hypothesis

evaluating the performance of each sub-hypothesis;

selecting one sub-hypothesis for each frequency band based on the evaluated performance; and

scheduling the one or more terminals in each selected sub-hypothesis for uplink data transmission on the corresponding frequency band.

49. The method of claim 48, wherein signals transmitted from the one or more scheduled terminals in the selected sub-hypothesis for each frequency band are processed in a particular order determined by the ordering for the sub-hypothesis.

50. The method of claim 48, wherein the evaluating for each sub-hypothesis includes

processing each signal hypothetically transmitted from each terminal in the sub-hypothesis to provide a corresponding processed signal, and

determining a signal-to-noise-and-interference ratio (SNR) for each processed signal.

51. The method of claim 50, wherein one sub-hypothesis is formed for each hypothesis, and wherein the ordering in the sub-hypothesis is selected to achieve a best performance for the hypothesis, as determined by one or more performance metrics.

52. A memory communicatively coupled to a digital signal processing device (DSPD) capable of interpreting digital information to:

receive channel state information (CSI) indicative of channel estimates for a plurality of terminals in a wireless communication system;

form at least one set of terminals for possible data transmission for each of a plurality of frequency bands, wherein each set includes one or more terminals and corresponds to a hypothesis to be evaluated;

evaluate the performance of each hypothesis based in part on the channel state information for the one or more terminals in the hypothesis;

select one hypothesis for each frequency band based on the evaluated performance; and

schedule the one or more terminals in each selected hypothesis for data transmission on the corresponding frequency band.

53. A computer program product for scheduling data transmission for a plurality of terminals in a wireless communication system, comprising:

code for receiving channel state information (CSI) indicative of channel estimates for a plurality of terminals in the communication system;

code for forming at least one set of terminals for possible data transmission for each of a plurality of frequency bands, wherein each set includes one or more terminals and corresponds to a hypothesis to be evaluated;

code for evaluating the performance of each hypothesis based in part on the channel state information for the one or more terminals in the hypothesis;

code for selecting one hypothesis for each frequency band based on the evaluated performance;

code for scheduling the one or more terminals in each selected hypothesis for data transmission on the corresponding frequency band; and

a computer-usable medium for storing the codes.

54. A scheduler in a multiple-input multiple-output (MIMO) communication system utilizing orthogonal frequency division multiplexing (OFDM), comprising:

means for receiving channel state information (CSI) indicative of channel estimates for a plurality of terminals in the communication system;

means for forming at least one set of terminals for possible data transmission for each of a plurality of frequency bands, wherein each set includes one or more terminals and corresponds to a hypothesis to be evaluated;

means for evaluating the performance of each hypothesis based in part on the channel state information for the one or more terminals in the hypothesis;

means for selecting one hypothesis for each frequency band based on the evaluated performance; and

means for scheduling the one or more terminals in each selected hypothesis for data transmission on the corresponding frequency band.

55. The scheduler of claim 54, further comprising:

means for forming one or more sub-hypotheses for each hypothesis, wherein each sub-hypothesis corresponds to specific assignments of a plurality of transmit antennas to the one or more terminals in the hypothesis for downlink data transmission, wherein the performance of each sub-hypothesis is evaluated and one sub-hypothesis is selected for each frequency band based on the evaluated performance.

56. The scheduler of claim 54, further comprising:

means for forming one or more sub-hypotheses for each hypothesis, wherein each sub-hypothesis corresponds to a specific order for processing uplink data transmissions from the one or more terminals in the hypothesis, wherein the

performance of each sub-hypothesis is evaluated and one sub-hypothesis is selected for each frequency band based on the evaluated performance.

57. The scheduler of claim 54, further comprising:

means for prioritizing the plurality of terminals to be scheduled for data transmission.

58. A base station in a multiple-input multiple-output (MIMO) communication system utilizing orthogonal frequency division multiplexing (OFDM), comprising:

a scheduler operative to receive channel state information (CSI) indicative of channel estimates for a plurality of terminals in the communication system, select a set of one or more terminals for data transmission for each of a plurality of frequency bands, and assign the one or more terminals in each selected set with a plurality of spatial subchannels in the corresponding frequency band;

a transmit data processor operative to receive and process data to provide a plurality of data streams for transmission to one or more scheduled terminals, wherein the data is processed based on the channel state information for the one or more scheduled terminals;

at least one modulator operative to process the plurality of data streams to provide a plurality of modulated signals; and

a plurality of antennas configured to receive and transmit the plurality of modulated signals to the one or more scheduled terminals.

59. The base station of claim 58, wherein the scheduler is further operative to select a data rate for each data stream.

60. The base station of claim 58, wherein the scheduler is further operative to select a coding and modulation scheme to be used for each data stream, and wherein the transmit data processor is further operative to process the data for each data stream based on the coding and modulation scheme selected for the data stream.

61. The base station of claim 58, further comprising:

at least one demodulator operative to process a plurality of signals received via the plurality of antennas to provide a plurality of received signals, and

a receive data processor operative to process the plurality of received signals to derive channel state information for the plurality of terminals in the communication system.

62. A transmitter apparatus in a multiple-input multiple-output (MIMO) communication system utilizing orthogonal frequency division multiplexing (OFDM), comprising:

means for receiving channel state information (CSI) indicative of channel estimates for a plurality of terminals in the communication system;

means for selecting a set of one or more terminals for data transmission for each of a plurality of frequency bands;

means for assigning the one or more terminals in each selected set with a plurality of spatial subchannels in the corresponding frequency band;

means for processing data to provide a plurality of data streams for transmission to one or more scheduled terminals, wherein the data is processed based on the channel state information for the one or more scheduled terminals;

means for processing the plurality of data streams to provide a plurality of modulated signals; and

means for transmitting the plurality of modulated signals to the one or more scheduled terminals.

63. A terminal in a multiple-input multiple-output (MIMO) communication system, comprising:

a plurality of antennas, each antenna configured to receive a plurality of transmitted signals and to provide a respective received signal;

a plurality of front-end units, each front-end unit operative to process a respective received signal to provide a corresponding stream of samples, and to derive channel state information (CSI) for a plurality of sample streams;

a receive processor operative to process the plurality of sample streams from the plurality of front-end units to provide one or more decoded data streams; and

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a transmit data processor operative to process the channel state information for transmission, and

wherein the terminal is one of one or more terminals included in a set scheduled for data transmission via one or more of a plurality of frequency bands for a particular time interval.

64. The terminal of claim 63, further comprising:

at least one demodulator operative to process the plurality of sample streams to provide one or more received symbol streams for one or more spatial subchannels of one or more frequency subchannels assigned to the terminal for downlink data transmission.

65. A multiple-input multiple-output (MIMO) communication system utilizing orthogonal frequency division multiplexing (OFDM), comprising:

a scheduler operative to receive channel state information (CSI) indicative of channel estimates for a plurality of terminals in the communication system, select a set of one or more terminals for data transmission on each of a plurality of frequency bands, and assign the one or more terminals in each selected set with a plurality of spatial subchannels in the corresponding frequency band;

a base station operative to process transmissions for one or more terminals scheduled for data transmission on the plurality of spatial subchannels of the plurality of frequency bands; and

a plurality of terminals, each terminal operative to communicate with the base station via one or more spatial subchannels of one or more frequency bands assigned to the terminal when scheduled for data transmission by the scheduler.